WHAT IS CLAIMED IS:

1. An evaluation mask for evaluating a projection-type exposure apparatus, the mask comprising:

at least one diffraction grating pattern for producing a diffracted light of the positive first-order and a diffracted light of negative first-order, diffraction efficiencies of the diffracted lights being different respectively, one of the diffracted lights having a magnitude that is substantially zero, and an image of the at least one diffraction grating pattern being projected onto a test substrate or an image detector by the projection-type exposure apparatus; and

a reference pattern for obtaining a reference image to measure a displacement of the image of the at least one diffraction grating pattern, and an image of the reference pattern being projected onto the test substrate or the image detector by the projection-type exposure apparatus,

wherein the images of the at least one diffraction grating pattern and the reference pattern projected onto the test substrate or the image detector are used for evaluating the projection-type exposure apparatus.

2. The evaluation mask according to claim 1, wherein

the reference pattern includes a diffraction grating pattern that is symmetric relative to the

diffraction grating pattern.

3. The evaluation mask according to claim 1, wherein

the reference pattern includes a first reference pattern and a second reference pattern and the at least one diffraction grating pattern is arranged between the first reference pattern and the second reference pattern.

4. The evaluation mask according to claim 1, wherein

the at least one diffraction grating pattern include a first diffraction grating pattern and a second diffraction grating pattern, and the reference pattern is arranged between the first diffraction grating pattern and the second diffraction grating pattern.

5. The evaluation mask according to claim 1, wherein

the at least one diffraction grating pattern include a first diffraction grating pattern and a second diffraction grating pattern, and the reference pattern includes a first reference pattern and a second reference pattern; and

the first diffraction grating pattern and the first reference pattern being arranged in parallel with each other on a first straight line, the second diffraction grating pattern and the second reference

pattern being arranged in parallel with each other on a second straight line running perpendicularly relative to the first straight line.

6. The evaluation mask according to claim 1, further comprising:

a trim pattern; and

a part of the group of line pattern which comprises the image of the at least one diffraction grating pattern being covered with the image of the trim pattern when the trim pattern and the diffraction grating pattern are exposed to light and images of the trim pattern and the at least one diffraction grating pattern are superposed.

7. The evaluation mask according to claim 1, wherein

a plurality of pairs of the at least one diffraction grating pattern and the reference pattern are arranged rotationally at every 45° or 22.5°.

8. The evaluation mask according to claim 1, wherein

the diffraction grating pattern includes a light-shield section for shielding light and first and second transparent sections for transmitting light; and

the absolute value of the difference between a phase of light transmitted through the first transparent section and a phase of light transmitted through the second transparent section being other than

180°.

9. The evaluation mask according to claim 8, wherein

the absolute value is equal to 90°.

10. An evaluation mask according to claim 9, wherein

the ratio of the width of the light-shield section, the width of the first transparent section and the width of the second transparent section is substantially 2 : 1 : 1.

11. An evaluation mask for evaluating a projection-type exposure apparatus, the mask comprising:

at least one diffraction grating pattern for producing a diffracted light of the positive first-order and a diffracted light of negative first-order, diffraction efficiencies of the diffracted lights being different respectively, one of the diffracted lights having a magnitude that is substantially zero, the at least one diffraction grating pattern comprising a light-shield section for shielding light and first and second transparent sections for transmitting light, the absolute value of the difference between a phase of light transmitted through the first transparent section and a phase of light transmitted through the second transparent section being 90°, and an image of the at least one diffraction grating pattern being projected

onto a test substrate or an image detector by the projection-type exposure apparatus; and

a reference pattern for obtaining a reference image to measure a displacement of the image of the at least one diffraction grating pattern, and an image of the reference pattern being projected onto the test substrate or the image detector by the projection-type exposure apparatus,

wherein the images of the at least one diffraction grating pattern and the reference pattern projected onto the test substrate or the image detector are used for evaluating the projection-type exposure apparatus.

12. A focus measuring method for measuring a defocus of an image of a test mark formed on a focus test mark projected on a substrate, the image being projected by a projection-type exposure apparatus, the projection-type exposure apparatus projecting an image of a mask pattern formed in a photo mask onto the substrate by way of a projection optical system comprising:

preparing an evaluation mask as the focus test mark, the evaluation mask comprising: at least one diffraction grating pattern for producing a diffracted light of the positive first-order and a diffracted light of negative first-order, diffraction efficiencies of the diffracted lights being different respectively, one of the diffracted lights having a magnitude that is

substantially zero, and a reference pattern for obtaining a reference image to measure a displacement of the image of the at least one diffraction grating pattern,

preparing a substrate with a photo sensitizing material;

exposing the image of the diffraction grating pattern and the image of the reference pattern onto the substrate simultaneously, the diffraction grating pattern and the reference pattern comprising a test mark in the evaluation mask;

exposing an image of a trim pattern onto the substrate if the trim pattern exists in the evaluation mask; and

measuring the relative distance of the image of the diffraction grating pattern formed on the substrate and the image of the reference image formed on the substrate.

13. The focus measuring method according to claim 12, wherein

the reference pattern is a diffraction grating pattern that is symmetric relative to the diffraction grating pattern.

14. The focus measuring method according to claim 12, wherein

the reference pattern includes a first reference pattern and a second reference pattern and the at least

one diffraction grating pattern is arranged between the first reference pattern and the second reference pattern.

15. The focus measuring method according to claim 12, wherein

the at least one diffraction grating pattern include a first diffraction grating pattern and a second diffraction grating pattern and the reference pattern is arranged between the first diffraction grating pattern and the second diffraction grating pattern.

16. The focus measuring method according to claim 12, wherein

the at least one diffraction grating pattern include a first diffraction grating pattern and a second diffraction grating pattern and the reference pattern includes a first reference pattern and a second reference pattern; and

the first diffraction grating pattern and the first reference pattern being arranged in parallel with each other on a first straight line, the second diffraction grating pattern and the second reference pattern being arranged in parallel with each other on a second straight line running perpendicularly relative to the first straight line.

17. A focus measuring method for measuring a defocus of an image of a test mark formed on a focus

test mark projected on a substrate, the image being projected by a projection-type exposure apparatus, the projection-type exposure apparatus projecting an image of a mask pattern formed in a photo mask onto the substrate by way of a projection optical system comprising:

preparing an evaluation mask as the focus test mark, the evaluation mask comprising: at least one diffraction grating pattern for producing a diffracted light of the positive first-order and a diffracted light of negative first-order, diffraction efficiencies of the diffracted lights being different respectively, one of the diffracted lights having a magnitude that is substantially zero, and a reference pattern for obtaining a reference image to measure a displacement of the image of the at least one diffraction grating pattern; and

measuring the relative distance of the image of the diffraction grating pattern formed on the substrate and the image of the reference image formed on the substrate.

18. A focus measuring method for measuring a defocus of an image of a test mark formed on a focus test mark projected on a substrate, the image being projected by a projection-type exposure apparatus, the projection-type exposure apparatus projecting an image of a mask pattern formed in a photo mask onto the

substrate by way of a projection optical system comprising:

preparing an evaluation mask as the focus test mark, the evaluation mask comprising at least one diffraction grating pattern for producing a diffracted light of the positive first-order and a diffracted light of negative first-order, diffraction efficiencies of the diffracted lights being different respectively, one of the diffracted lights having a magnitude that is substantially zero, the at least one diffraction grating pattern comprising a light-shield section for shielding light and first and second transparent sections for transmitting light, the absolute value of the difference between a phase of light transmitted through the first transparent section and a phase of light transmitted through the second transparent section being 90°, and a reference pattern for obtaining a reference image to measure a displacement of the image of the at least one diffraction grating pattern; and

measuring the relative distance of the image of the diffraction grating pattern formed on the substrate and the image of the reference image formed on the substrate.

19. An aberration measuring method for measuring an aberration of a projection-type exposure apparatus based on a defocus of an image of a test mark formed on

a focus test mark projected on a substrate, the image being projected by the projection-type exposure apparatus, the projection-type exposure apparatus projecting an image of a mask pattern formed in a photo mask onto the substrate by way of a projection optical system comprising:

preparing an evaluation mask as the focus test mark, the evaluation mask comprising: at least one diffraction grating pattern for producing a diffracted light of the positive first-order and a diffracted light of negative first-order, diffraction efficiencies of the diffracted lights being different respectively, one of the diffracted lights having a magnitude that is substantially zero, and a reference pattern for obtaining a reference image to measure a displacement of the image of the at least one diffraction grating pattern,

preparing a substrate with a photo sensitizing material;

exposing the image of the diffraction grating pattern and the image of the reference pattern onto the substrate simultaneously, the diffraction grating pattern and the reference pattern comprising a test mark in the evaluation mask under the condition of $\lambda/\{NA\ (1 - \sigma)\} \leqq P \leq 2 \leqq \lambda/\{NA\ (1 + \sigma)\}$, where σ is a partial coherence of a lighting optical system for lighting the test mark, P is a period of the image of

the first pattern of the test mark, λ is the wavelength of light of the lighting optical system and NA is a numerical aperture of the projection optical system;

exposing an image of a trim pattern onto the substrate if the trim pattern exists in the evaluation mask; and

measuring the relative distance of the image of the diffraction grating pattern formed on the substrate and the image of the reference image formed on the substrate.

20. An aberration measuring method according to claim 19, wherein

the reference pattern is a diffraction grating pattern that is symmetric relative to the diffraction grating pattern.

21. An aberration measuring method according to claim 19, wherein

the reference pattern includes a first reference pattern and a second reference pattern and the diffraction grating pattern is arranged between the first reference pattern and the second reference pattern.

22. An aberration measuring method according to claim 19, wherein

the diffraction grating pattern include a first diffraction grating pattern and a second diffraction

grating pattern and the reference pattern is arranged between the first diffraction grating pattern and the second diffraction grating pattern.

23. An aberration measuring method according to claim 19, wherein

the diffraction grating pattern include a first diffraction grating pattern and a second diffraction grating pattern and the reference pattern includes a first reference pattern and a second reference pattern; and

the first diffraction grating pattern and the first reference pattern being arranged in parallel with each other on a first straight line, the second diffraction grating pattern and the second reference pattern being arranged in parallel with each other on a second straight line running perpendicularly relative to the first straight line.